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ABSTRACT

The concept of mediated learning is examined, focusing on the work of L. Vygotsky (1896-1934) and R. Feuerstein (born 1921). Mediated learning is the subtle social interaction between teacher and learner in the enrichment of the student's learning experience. Both theorists take a strong sociological approach to the development of intelligence and cognition; their socio-cultural psychology seeks to place human beings in a larger biological context. Mediation for learning is an important key to survival and success. Feuerstein makes an important distinction between functions (a Vygotskian concept) that serve as prerequisites of cognition, and cognitive operations, which correspond more or less to the Piagetian notion of intellectual operations. Empirical studies were conducted to apply each theorist's view. The Vygotskian study examined the discovery of contradictions in pictured situations for 19 young adult Russian immigrants to Israel who were special education teachers. The Feuerstein-based study was conducted between January and June of 1991 and examined thinking among 151 American minority middle grade (grades 5 through 7) students, 29 of whom were in special education. In both studies, the use of tools of instruction, embedded in scaffolding or apprenticeship models of learning, highlighted tasks of internalization of ability through mediation. Recognizing the importance of mediated learning could cause the teacher's role to move from provider of knowledge to learning facilitator, as the student becomes self-regulated, independent, and creative. There is a 57-item list of references. (SLD)

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MEDIATED LEARNING - THE CONTRIBUTIONS OF VYGOTSKY AND FEUERSTEIN IN THEORY AND PRACTICE

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MEDIATED LEARNING - THE CONTRIBUTIONS OF VYGOTSKY AND FEUERSTEIN IN THEORY AND PRACTICE

The dynamic involvement of the learner in the construction of his/her own knowledge system is not just a recent goal of educational reform. Various theorists in the history of twentieth century psychology have made contributions to the approaches and research supporting this view (Belmont, 1989; Piaget, 1973; Sternberg, 1990). This study examines the concept of **mediated learning**, the subtle, social interaction between the teacher and the learner in the enrichment of the student's learning experience. It focuses on the work of two major figures of socio-cultural psychology, Lev Vygotsky (1896-1934) and Reuven Feuerstein (b. 1921). First, their theoretical positions are examined, followed by the review of a recent, practical application of each man's work. Finally, mediated learning is discussed in terms of its relationship to current, educational change.

Introduction of the Study

Theoretically, and in terms of recent classroom practice, both Vygotsky's and Feuerstein's research are significant influences on the ways students are being instructed all over the world. Tharp and Gallimore (1991) suggest that Vygotsky's socio-historical approach is profoundly affecting education's understanding of teaching, learning, and student cognitive development. Sternberg (1990) maintains that both theorists underline the importance of socialization for intelligence and its development. In Feuerstein's "mediated learning experience," he proposes, the process by which Vygotsky's internalization of higher psychological

functions occurs is actually described. The questions central to this study emerge from this general relationship

- What is mediated learning for Vygotsky and Feuerstein?
- Of what significance is mediation for effective instruction?
- What implications does mediation have for different populations of learners?
- How does mediated learning extend the cognitive psychologist's new paradigm for education?

Initially, it is useful to consider these questions from a historic understanding of mediated learning in socio-cognitive theory.

Natural to Human Distinctions

The acknowledgment of mediated learning changes perspectives in both animal and human behavior. Consider first how children or animals learn to avoid dangerous objects. According to a classical, behavioristic paradigm, such learning must include a number of direct exposures of the child to a dangerous stimulus (e.g., a hot object), which in due time results in the formation of a conditioned avoidance reflex. This mechanism, which indeed can be studied in animals under experimental laboratory conditions, seems to have a very low ecological validity. Ethological studies suggest that avoidance of harmful stimuli is achieved in quite a different way (Bronson, 1968). Young animals tend to avoid all objects which have not previously been encountered in the presence of the mother. Learning, therefore, is achieved not through direct exposure, but through the indirect experience or mediation provided by the presence (or absence) of the mother.

The role of mediation becomes even more pronounced in human learning. Aside from cases of severe social-cultural deprivation (to be discussed later), the human child does not learn about harmful stimuli through direct exposure to them. Instead, a complex process of mediated learning takes place, with the mother or another caretaker inserting him/herself "between" the stimuli and the child. The caretaker indicates to the child which

objects are dangerous. Sometimes, the caretaker deliberately exposes a child to a dangerous or unpleasant stimulus under controlled conditions, creating the equivalent of a psychological "vaccination." The caretaker explains to the child the meaning of dangerous situations. Finally, the caretaker stimulates generalization, creating in the child the notions of a dangerous situation and a possible response to it.

The above example suggests that there is a **qualitative** difference between learning based on the direct exposure to stimuli and learning **mediated** by another human being. Before presenting the psychological theory of mediated learning for either Vygotsky or Feuerstein, it seems relevant to discuss briefly the philosophical, sociological, and linguistic aspects of mediated interaction.

The Roots of Mediated Learning: Philosophical, Sociological, and Linguistic

On the philosophical plane, the notion of mediation (Vermittlung) constitutes one of the cornerstones of the Hegelian philosophical system. Both directly and indirectly, particularly through Marx, this notion influenced Vygotsky's theory, as well as the work of his followers such as Leontiev (1978) and Luria (1976).

According to Hegel, the very existence of a human type of activity depends on the transition from the immediate, animal type of satisfaction of needs, which coincides with the ability of the individual animal, to the human satisfaction of needs dependent on the activity of others. Human beings satisfy their needs indirectly through work with end products which are intended not for the producer him/herself, but for others.

> The being that acts to satisfy its own instincts, which - as such - are always natural, does not rise above Nature: it remains a natural being, an animal. But by acting to satisfy an instinct that is not my own, I am acting in relation to what is not - for me - instinct. I am acting in a relation to an idea, a nonbiological end. (Kojeve, 1986, p. 42)

Hegel links the emergence of human consciousness and self-consciousness to this process of mediated activity which is work. The philosophical notion of mediation already suggests a whole range of possible mediating agents. First, work presupposes material tools interposed between the human individual and the natural object. These tools, though directed at natural objects, also have a reciprocal influence on the individual, changing his/her type of activity and cognition. Secondly, since work is nearly always work for somebody else, then social and psychological characteristics of the other person also enter the equation. Finally, since work is impossible without symbolic representations, they and the means of their transmission become two additional mediatory agents.

On the sociological plane, the issue of mediatory mechanisms embedded in the structure of human society was raised by G.H. Mead (1974). Mead made an important distinction between stimuli and objects. Instead of just perceiving and responding to stimuli, he suggested objects are not given -- they are "constructed." The construction of objects becomes possible only because stimuli of the environment take on certain meanings in the course of human activity which is social in nature. Mead's ideas influenced others.

> The meaning of a thing for a person grows out of the ways in which other persons act toward the person with regard to the thing...Their actions operate to define the thing for the person. Thus, symbolic interactionism sees meanings as social products, as creations that are formed in and through the defining activities of people as they interact. (Blumer, 1969, pp. 4-5)

The interaction between the individual and the environment is never immediate, it is always mediated by meanings which originate "outside" the individual -- in the world of social relations. Moreover, unlike animals, human beings are capable of becoming objects to themselves.

Feuerstein (Feuerstein & Feuerstein, 1991) has broadly defined Mediated

Learning Experience (MLE) very much in this sociological framework. MLE is the interaction of the organism with its environment via a human mediator (p. 3). From this relationship, then, it seems an essential feature of human cognition is that it is based on the internalized forms of what originally appeared as **social interactions**. Internalized gestures, verbal as well as non-verbal, become significant symbols whose meaning is shared by a group of individuals, say the child's family. The role play of a child who addresses him/herself as a teacher, or arrests him/herself as a police person, is an example of an early experience of being another to one's self.

Many of these same problems were independently formulated in the context of language and literature studies. A pioneering effort was made by the Russian literary scholar and philosopher, Mikhail Bakhtin (1986). Bakhtin argued that instead of starting with individual speech (understood as a natural phenomenon) and proceeding toward written forms of language, it might be more advantageous to start at the highest point of language development -- a literary text -- and to look, from this vantage point, at the less complex forms of verbal activity. Language, as it reveals itself in literary discourse, he proposed, offers a paradigm for any human action to the extent that this action is addressed and interpreted. Individual oral speech and verbal thought can thus be comprehended as "degenerate" or "underdeveloped" forms of literary discourse.

The quality of literary discourse, for example, often depends on the writer's ability to manipulate different genres of speech within a given text. Mediation suggests the use of the language is significant. As Bruner (1966) noted years ago when searching for a theory of instruction, "...it is obviously not the language per se that makes the difference; rather, it seems to be the use of language as an instrument of thinking that matters,

its internalization, to use an apt but puzzling word" (p. 14). This same linguistic skill is needed in ordinary life, not only for using appropriate greetings or words or condolences, but also for the development of one's free, creative narratives. A study of genres in individual speech returns to the already-mentioned problem of mediation through social roles. Though empirically observable in individual speech, speech genres belong to the social realm; they are **super**-individual. Human speech, therefore, is not a free combination of permitted linguistic forms, but involves much bigger units which are genre-specific utterances. What on the social-psychological level is identified as role, position, status, or attitude, on the linguistic level finds its expression in the genre-specificity of individual speech.

Only recently have these ideas on mediation become adopted by psychologists and led to inquiries into the influence of the narrative style on the individual's description and comprehension of his/her own life (Bruner, 1987). Similarly, only in the last decade or so has the concept of learning that is mediated been seriously examined as a construct for a better understanding of cognitive development in the classroom (Belmont, 1989; Goldenberg, 1991; Palincsar & Brown, 1984; Tharp & Gallimore, 1991).

Elaboration on Theory

Mediated learning is part of a larger movement in the development of psychology that has seen the replacement of the behaviorist's model by a more cognitive conception of human intelligence and learning (Gardner, 1985). Both Feuerstein (1980) and Vygotsky (1986) developed their theories under strong influence of Jean Piaget, who can legitimately be called the "father" of cognitive developmental psychology. However, both of them were dissatisfied with certain aspects of the Piagetian approach. For Vygotsky,

there was concern about epistemological individualism in Piaget's theory and the neglect of social mediation. For Feuerstein, there was the issue of the concrete mechanisms of learning through the mediation of another human being. Mediation assumes a changing nature to human intelligence, a pliability and a dynamic quality in contrast to behaviorism's static definition. Indeed, the problem of **inert** knowledge, says Bransford and his associates (1986), with its corollary of passive learning, are central concerns today for building a meaningful curriculum in the classroom.

Mediation also stresses the communal understanding of knowledge, not only in the collaborative sharing of experience but in the sorting or categorizing of ideas. The mediator helps the learner "frame, filter, and schedule stimuli," says Feuerstein (1980), and, ultimately, influences the potential ways that transfer of knowledge occurs in the student's thinking (Perkins & Salomon, 1988). Mediation assumes that instruction is more concerned with **going beyond** the information given, with connecting the present with both the past and the anticipation of the future, than with mastering specific bits of here-and-now data.

The approach of mediated learning suggests a new paradigm for education, one in which intelligence itself is redefined and conceived. What is intelligence, asks Feuerstein? The ability to learn and change. Intelligence is now much more broadly understood than a narrow, static I.Q. test presumes. In fact, according to current researchers (Detterman & Sternberg, 1982; Diamond, 1988), reflective, intelligent behavior can actually be enhanced. Understanding the work of Vygotsky and Feuerstein is to begin to discover what the new educational paradigm is all about.

Vygotsky's Approach to Mediated Learning

Vygotsky (1978; 1986) proposed that higher mental processes can be

considered as functions of mediated activity. He suggested three major classes of mediators: material tools, "psychological tools," and other human beings (see Kozulin, 1990a). Material tools have only indirect influence on human psychological processes, because they are directed at the processes in nature. Nevertheless, the use of material tools puts new demands on human mental processes. Vygotsky suggested that the historical progress of tool-mediated activity from the primitive to more advanced forms should be taken into account in a study of comparative human cognition (Vygotsky & Luria, 1930).

Material tools do not exist as individual implements; they presuppose collective use, interpersonal communication, and symbolic representation. This symbolic aspect of the tool-mediated activity gives rise to a new and important class of mediators, which Vygotsky designated as "psychological tools." While material tools are directed at the objects of nature, psychological tools mediate humans' own psychological processes. Among the most ancient psychological tools Vygotsky (1978) mentioned are such psychological "fossils" as "casting lots, tying knots, and counting fingers" (p. 127). Casting lots appears in a situation when the uncertainty of decision caused by the presence of two equipotent and opposing stimuli is resolved by an application of the artificial and arbitrary stimulus -- dice aimed at the subject's own psychological processes. Tying knots exemplifies the introduction of an elementary, external mnemonic device to ensure the retrievel of information from memory. Finger counting is the adaptation of an always-available "tool" for the organization of higher mental processes involved in elementary arithmetic operations.

Beyond these primitive "tools" lies the vast area of higher order symbolic mediators which include natural and artificial languages,

discourses and cultural-symbolic systems of different epochs and nations. One of the major goals of Vygotsky's theory was to develop a typology of higher mental processes which would reflect historical transition from one system of psychological tools to another. An empirical study of such a transition and its psychological consequences was undertaken by Vygotsky and Luria in the context of cultural change in Soviet Central Asia in the early 1930's (Luria, 1976). On the ontogenetic plane, Vygotsky's (1986) contribution was primarily in studying changes in conceptual reasoning of children produced by the growing sophistication of verbal mediation.

As to mediation through another individual, Vygotsky (1978) suggested two possible approaches. The first was expressed in the famous statement that "every function in the child's cultural development appears twice: first, between people (interpsychological), and then inside the child (intrapsychological) (p. 57). As an illustration, Vygotsky cited the phenomenon that was first noticed by J.M. Baldwin and later investigated by Jean Piaget, namely that a child's ability to consider different points of view on the mental plane depends on actual arguments between children. More recently, this phenomenon was discussed by Miller (1987).

The second approach focuses on the role of the other individual as a mediator of meaning. An illustrative example here is the development of indicatory gesticulation in the child. According to Vygotsky (1978), gesture first appears as a natural attempt to grasp an object. The grasping movement is interpreted by an adult as a gesture; thus the human meaning of the natural act is supplied to the child from "outside" by the adult. The addressee of the movement accordingly changes from that of the object to that of a human subject. Movement itself becomes transformed and reduced -- it "starts" as a grasping attempt and "becomes" a real gesture. Later, such

gestures are internalized and form the child's inner commands to himself or herself. The meaning of one's own activity is thus formed by mediation through another individual. Vygotsky (1983) believed that this principle holds for the entire personality as well: "One may say that only through the other do we become ourselves, this rule applies to each psychological function as well as to the personality as a whole" (p. 144). In recent years, these ideas of Vygotsky were amplified, but also challenged at certain points, by Trevarthen's (1978, 1988) notion of "secondary intersubjectivity," Rogoff's (1990) theme of "guided participation," Wertsch and Minick's (1990) notion of the "negotiation of sense," and Tharp and Gallimore's (1991) concept of "assisted performance."

For the purpose of the present discussion, it is important to emphasize that mediation through another individual is closely linked in Vygotsky's theory to the notion of symbolic function. A human individual as a mediator appeared first and foremost as a carrier of signs, symbols, and meanings. In terms of educational application, the most popular of Vygotskian ideas in the West became the "Zone of Proximal Development" (ZPD) (Rogoff & Wertsch, 1984). Operationally, ZPD is defined as a difference in the child's achievement in assisted versus unassisted performance. Vygotsky (1986) argued that assisted performance reveals those capacities of the child which are not manifest yet, but which have already undergone inner development. The child with wider ZPD has a better chance to succeed in school learning. Learning in the ZPD, according to Vygotsky, is also associated with an interaction between spontaneous concepts of the child and systematic, "scientific" concepts introduced by the teacher.

In Vygotsky's theory, no attempt was made to differentiate between human mediators beyond their function as vehicles of symbolic mediation. As

mentioned elsewhere (Kozulin, 1990a), Vygotsky only declared that concept formation and communication have one common, vital point -- word meaning. But, while the hierarchy of concept formation was explored in considerable detail by Vygotsky (1986), the corresponding study of communicative situations was not elaborated beyond a general counterposition of classroom instruction and spontaneous everyday learning. This left considerable lacunae or missing parts in Vygotsky's theory of mediation. These lacunae, ultimately, have been addressed by the work of other psychologists and educators -- notably by Reuven Feuerstein and his colleagues. In understanding the contributions of both Vygotsky and Feuerstein to mediated learning theory, many issues related to this important topic can be seen in a new light.

Feuerstein's Approach to Mediated Learning

Mediated learning experience, or MLE according to Feuerstein, is broadly seen as the interaction between the human being and its socio-cultural environment. But MLE does not include all interactions -- rather, MLE is concerned with experiences that influence the individual's "propensity to learn," the quality of interaction that helps the learner "become modified by exposure to stimuli in the direction of higher and more efficient levels of functioning and adaptation" (Feuerstein & Feuerstein, 1991, p. 5). The central question which Feuerstein's MLE theory attempts to answer is: What is the cause of differential cognitive development? The central aspect of mediation is the change that qualitatively influences the learner and enables him/her to develop cognitive prerequisites for learning on his/her own from direct stimuli (Kozulin, 1991).

Feuerstein (1990) maintains that different learners have different capacities to benefit from mediated experience. Every individual exhibits

differences in terms of their cognitive structure, their knowledge base, and their operational functioning. Given the same stimuli, different learners can show considerable variations in the degrees of rapidity, generalizability, and permanence of changes with which they respond to instruction. For some, a slight change in color, shape, or size might neutralize the effects of a previously learned response -- and require a new process of learning, as if a lesson were totally new and unfamiliar. Feuerstein's point is that MLE, as a quality of interaction, is responsible for two major phenomena unique to human beings: modifiability and diversity. These two phenomena are closely intertwined and contribute to every human learner's considerable cognitive plasticity and flexibility. It is the existence of these two phenomena which Feuerstein maintains is unexplained in earlier theories of cognitive development.

What are the parameters or criteria of MLE? Feuerstein (1990) distinguishes twelve major criteria of MLE. The first three criteria need to be accounted for in every learning exchange that constitutes MLE, they are universals. These criteria include: mediation of intentionality and reciprocity, mediation of transcendence, and mediation of meaning. The remaining nine criteria are not to be considered exhaustive, but are seen rather as a first selection of qualities of interaction that may -- but need not -- appear in each interaction in order to turn it into a mediating experience. Feuerstein considers the presence of any of these secondary parameters is situationally determined and varies greatly according to societal, environmental, and cultural factors. These nine criteria include: mediation of a feeling of competence; mediation of regulation and control of behavior; mediation of sharing behavior; mediation of individuation and psychological differentiation; mediation of goal-seeking, goal-setting,

planning, and goal-achieving behavior; mediation for challenge: the search for novelty and complexity; mediation of an awareness of the human as a changing entity; mediation of the search for an optimistic alternative; and mediation of the feeling of belonging.

The criterion of intentionality turns the interactive situation from a random, incidental experience into one that is intentional. This intentionality has two foci: one is the object of the learning, the other is the child or learner. Some characteristics of the object -- such as location, brightness, or arrangement -- are transformed by the adult in order to ensure its registration by the learner. The intention thus changes the learner's "state of mind, level of vigilance, and alertness," (Feuerstein, 1990, p. 97). These physical transformations are accompanied by direct statements from the adult informing the learner of the goals of mediation. The mediating teacher thus alters the instructional role; instead of being a mere provider of information, of data, of verbal directions, he/she has become a source of constant affirmation that objects or information involved are cognitively important to the learning, the capacity building, of the student (Kozulin, 1991).

The reciprocity aspect of Feuerstein's first criterion underlines the fact that it is not the object but the child's very cognitive processes that are the primary target of mediation. By constantly focusing on the learner's state of attention, the strategies that he/she is using, even mistakes and insights that may not yet seem directly relevant to a task, the adult shows the child that his/her response is what is really important. A reciprocity develops; mediated learning becomes a two-way street. Not only are the stimuli transformed by the first criterion, but the mental, emotional, and motivational states of the learner are transformed, as well

(Feuerstein & Feuerstein, 1991).

The second parameter of universal quality is the mediation of transcendence, to go beyond the goals of the particular interaction. Feuerstein (1990) points out that a mediator does not limit the length and breadth of an interaction to those parts of the situation that have originally initiated the exchange. Rather, he/she widens the scope of the interaction to goals that are at the moment more remote to the learner. For example, if a child points to an orange and asks what it is, merely to provide a label to name the object would be an unmediated response. A transcendent interaction would offer a broader definition, one that indicates categorical classification ("It's the fruit of a plant, a tree.") and provide other references to taste, smell, etc., in order to help the learner make further connections. Transcendence as a mediating criterion provides not only for the anticipated widening of cognitive factors in the information under question, but assumes the constant enlargement of the learner's own need system and his/her dynamic, continuous change.

One interesting aspect of the criterion of transcendence is pointed out by Kozulin (1991). To be effective, transcendence need not necessarily be either conscious or deliberate. Many parents skillfully employ mediation leading to transcendence without being aware of it. Much of this is provided through cultural development and transmission. By contrast, Feuerstein (1990) notes that transcendence is seldom, if ever, observed among animals who rather model behavior of particular and discrete intentions alone, very much limited by the organism's primary instinctual needs. Transcendence, for Feuerstein, is the most humanizing of the universal parameters.

The third universal parameter of mediation is the mediation of meaning.

In this criterion, Feuerstein (1991) finds the generator of the emotional, motivational, attitudinal, and value-oriented behaviors of the individual. It is the energetic dimension of an interaction; meaning deals with the questions of why, what for, and other reasons for which something is to happen or be done. The goal of this parameter is to make explicit those didactic or parental understandings that all-too-often are only implicit in exchanges with children. Sometimes they begin with kinesthetics and preverbal mimesis or gestures that express a parent's joy and encouragement. Gradually, later verbal exchanges are internalized by the learner who develops an "orientation" toward the search for such meaning, an expectation that reaches beyond the specific learning exchange.

Feuerstein emphasizes the importance of mediation of meaning in the context of cultural transmission. He notes that in the context of the modern world, where dialogues between parent and child and teacher and student are much too few, there is all-the-more a paucity of exchanges about meaning. This situation has grave consequences of both immediate and long-term concern:

> A parent who is reluctant to impart to his children the 'meaning' of existence impoverishes their lives, not only by certain contents, values, and motivations, but by denying them the very faculty and need to search and even construct for themselves the meanings of their lives and their activities. In the absence of these meanings, any substitute, no matter how noxious, comes to fill up the void and becomes acceptable even if it is self-destructive. (Feuerstein & Feuerstein, 1991, p. 27)

At the same time, in emphasizing that the three universal parameters together make possible the essence of what it is to be human, Feuerstein proposes that modifiability and flexibility are possible for any subject, at any time in their lives. Kozulin (1991) notes there are two major causes for the lack of MLE: the absence of mediation -- the failure to understand

and to provide such experiences -- and those conditions which render a normal amount or type of mediation insufficient or inadequate. Feuerstein's theory, says Kozulin (1991), is absolutely incompatible with certain behavioristic principles and practices which leave meaning beyond the sphere of psychological analysis and modification. It is easy to see, however, when applied to all learners, the consistency between Feuerstein's approach to mediation and the new paradigm for education.

Mediated Learning and Educational Application

Over the past two decades, Vygotsky and Feuerstein's theories of mediation have been applied to a multitude of educational practices and research. The work of Brown & Ferrara (1985), Goldenberg (1991), Kozulin (1990b), Rogoff (1990), Rogoff & Wertsch (1984), and Tharp & Gallimore (1988) report on specific applications of Vygotsky's concepts with learners from early childhood to adulthood, with subjects of limited language ability and various cultural backgrounds. Similarly, Feuerstein's theory has had extensive application with varied populations through the worldwide implementation of both an instructional program, Instrumental Enrichment (IE) (Emerson, 1991; Kaniel & Feuerstein, 1989; Link, 1985; Sharron, 1987), and an assessment technique, the Learning Potential Assessment Device (LPAD) (Haywood & Tzuriel, 1991; Lidz, 1987; Missiuna & Samuels, 1988). These studies are significant today in explicating the dimensions of the new cognitive paradigm for education.

While it is not the goal of this study to review extensively the findings of numerous researchers who have sought to apply Vygotsky and Feuerstein's theories, it is important to examine the work of the two socio-cultural psychologists in terms of the meanings of particular applications regarding mediation. Discussion in the next section reviews

a practical study of each theorist's concept of mediated learning in terms of the objectives set in his own writings. This discussion is followed by an examination of the outcomes of the specific applications in light of what has been learned in the "grand leap" from theory to practice.

Implementations of Mediated Learning

How do the seminal ideas of Vygotsky and Feuerstein play out in the real world? In practical applications of each theorist's approach, what happens when mediated learning intentionally directs instruction and how is it received by various types of learner populations and their teachers? Given the so-called cognitive revolution in education (Baars, 1986; Gardner, 1985), what are the possible changes in schooling that might take place if the goals of each of these socio-cultural psychologists are attempted and, to some extent, actualized? An examination of an application of each theorist's view of mediation was completed in the course of this study. These experiments are described herein.

A Vygotsky-based Study of Contradictions among Adult Russian Immigrants

In Vygotskian theory, cognitive progress is determined by the increased mastery of the individual over his/her own psychological processes through the use of psychological tools. Within this paradigm, the successful introduction of a psychological tool always brings about an advance in cognitive functioning. This paradigm has been challenged in the first application in this study which focussed on the discovery of contradictions in a written text (Kozulin, 1990b). Subjects in the study, a group of American students and young professionals, read the text which was plausible as prose, but which contained statements contradicting simple laws of physics ("river flowing uphill"). After their ability to detect contradictions spontaneously was established, the subjects were given verbal

(multiple choice) and pictorial tools which, according to the Vygotskian model, are supposed to improve the subjects' performance. Surprisingly, neither the multiple choice activity nor the pictorial tools were effective in evoking the memory of contradictions. Only 12% of the subjects reported contradictory statements after these types of mediation were applied. Moreover, from the subjects' narratives and their manipulations of a picture kit, it became clear that some subjects turned this kit into an instrument for rendering the cognitively dissonant information neutral.

These results may have a direct bearing on the problem of mediated experience as an integral component of learning activity. The failure of multiple choice items to serve as a means for the discovery of the contradictions indicates that even the choice of correct answers does not guarantee a fully conscious comprehension of the information involved. This underscores the difference between Feuerstein's understanding of mediation and both the Piagetian and the "activity theory" approaches. According to Piaget (1980), contradiction engenders cognitive conflict or disequilibrium which, in its turn, leads to insight. The problem that arises is that in order to be productive, contradiction should be experienced as such, and this does not necessarily always happen. Activity theory, proposed by Leontiev (1978), advanced the idea that in order to bring contradiction to consciousness some form of relevant activity needs to be organized. Our findings, however, indicate that even such a highly relevant activity as multiple choice assessment may have no effect on the subjects -- if there is no **mediation of meaning.** According to Feuerstein, the simple presence of an activity or of a tool related to both the task and the corresponding cognitive function does not yet constitute a mediated learning situation. For mediation to occur, the transmission of meaning, among other conditions,

must take place.

In addition to testing the Vygotskian hypothesis concerning psychological tools, this study also inquired into possible cross-cultural differences in the spontaneous discovery of contradictions. For that reason, stimulus material (a text that included statements contradicting elementary laws of physics) was adopted from the Soviet study by Tikhomirov and Klochko (1981), for young American subjects. It was reasoned that an extremely low level of spontaneous discovery of contradictions (3.8%) in the Soviet sample may reflect the lack of mediation of challenge in recent Soviet education. Therefore, in a course of study, if a student is not encouraged to look for novel and challenging features of the material, he/she will be unable to explore the material critically. The data obtained demonstrated that, indeed, spontaneous reporting of contradictions was much higher among American students and young professionals than among their Soviet peers (28% compared to 3.8%).

The problem remains, whether it is possible to teach cognitive strategies that will help a student discover contradictory information. This question has both general and more specific aspects. The general aspect concerns the effectiveness of Feuerstein's Instrumental Enrichment (IE) program used as a tool for the enhancement of analytic capacities in students. The specific cross-cultural aspect concerns the low level of spontaneous exploratory behavior identified in recent immigrants from the former Soviet Union. From clinical work with this population, initial impressions suggest that these immigrants display a high level of authoritarianism, low ambiguity of tolerance, and insufficient spontaneous exploratory behavior. In addition, it seems worthwhile to explore the relationships between cognitive strategies nurtured by the IE training and

the content knowledge necessary for the identification of contradictory information.

The following pilot study is part of a larger research project being conducted in Israel with recent adult immigrants from Russia. The pilot study was designed to answer the questions of whether the IE training can serve as a tool for the enhancement of analytic and exploratory strategies among these subjects, and how these cognitive strategies interact with content knowledge.

Subjects. The subjects in the study included 19 special education teachers, all new immigrants from Russia, who were enrolled in a retraining program that leads to their licensing as teachers in Israel.

Methods. In the pretest, subjects were presented with pictures of different physical situations and asked to explain which situations are possible and which are impossible under any conditions. The problems closely resembled those used by Piaget (1980) in his study of contradictions. Each student received four problems depicting physically possible and impossible situations.

The instructional phase included weekly training in the IE program over a period of four months, for the total of 50 hours. The following IE instruments were used: Organization of Dots, Orientation in Space, Comparisons, Analytic Perception, and Illustrations (Feuerstein, 1980). The IE training was part of the students' regular curriculum. The nature of the instruments and their teaching were such that they fostered a critical approach, exploratory behavior, and attention to contradictory information. At the same time, the IE instruments contained no cues that could be used in the solution of the posttest. The subjects received no training in physics nor in any other natural science content.

For the posttest, four problems similar -- but not identical -- to those in the pretest were used.

Results. Discovery of contradictions in the pretest was lower than expected. Only one student correctly identified all the impossible situations and correctly commented on contradictory material. Two students failed to discover even one contradictory point. The average success rate was 55%.

In the posttest, the average success rate was only slightly higher: 65%. At the same time, the pattern of responses changed significantly. Four subjects correctly identified all impossible situations, and no student scored a total failure. Moreover, all students whose success rate at the pretest was 25% or lower, improved their performance. Their average success rate became: 62.5%.

The average success rate for the group as a whole remained modest because some of the subjects who performed well on the pre-test performed less successfully on the posttest.

The analysis of subjects' comments and reasons for declaring certain situations possible or impossible revealed an interesting interaction between subjects' cognitive strategies and their content knowledge. Frequently, subjects' lack of elementary scientific knowledge and their reliance on quotidian experience prevented them from distinguishing between possible and impossible situations.

Conclusion. Short-term IE training seems to be effective in improving analytic, exploratory, and contradiction identification strategies in poorly performing adult learners. The effectiveness of cognitive strategies is limited by a subject's reliance on non-scientific, everyday experience in particular content areas.

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A Feuerstein-based Study of Thinking with American Minority Students

During the 1989-1990 school year, the Philadelphia School District, in collaboration with the Pennsylvania Department of Education, trained a group of educators (teachers, principals, supervisors, and school psychologists) from middle and elementary schools in two subdistricts of the city in the first level of Feuerstein's instructional intervention program, Instrumental Enrichment (IE). Nine teachers who had been trained and were using the materials with their middle-grade classes volunteered to be part of a study conducted between January and June, 1991. The objective of the study was to examine the effects of the IE materials and their instruction on the thinking of middle school students in these teachers' classes. Students were mainly of Latino and African American backgrounds. Seven teachers and a total of 161 students, of regular and special education status, participated fully in the project. Results were reported on a non-verbal measure of students' intelligence, the Standard Progressive Matrices test which was pre- and posttested (Raven, 1958); on students' report card marks; and on students' city-wide test scores obtained from a standardized, nationally-normed reading and mathematics instrument (Offenberg, 1992). The goals, methods, and outcomes of this study are reviewed in the following discussion.

Goals. The goals of the IE program seek to correct deficiencies in a student's cognitive development. Feuerstein and his associates (Feuerstein, Jensen, Hoffman, & Rand, 1985) identify the need to enhance the capacity of a low-functioning adolescent "to become modified as a result of exposure to new experiences" (p. 59), the IE lessons are those experiences. The deficiencies referred to are categorized in three phases: the quantity and quality of data gathered by the student, the efficient use of data available

to the student, and communication by the student of the outcome of elaborative processes. Obviously, students need to focus on the cognitive behaviors required to complete the various "instruments" in the first level of the IE program. This includes the concepts, labels, operations, and an understanding of relationships, stategies, and skills embedded in the content-free materials, particularly in the first two units or instruments introduced, Organization of Dots and Comparisons.

The IE program also seeks to change students from passive recipients of information to confident, active learners. Improved habit formation, particularly relative to intrinsic motivation on the student's part, is a focus of the program. "IE strives to help learners consolidate and internalize new operations, principles, and skills so fully that they are used as a result of an internal need and because of the economy that results from greater efficiency" (Feuerstein, Jensen, Hoffman, & Rand, 1985, p. 60). Feuerstein sees the controlled repetition and organization of activities in IE as approximating the mediated learning experience that is required for student internalization of ability; the learner spontaneously and fluently becomes able to be in control of the material on his/her own. Involved in this development is the student's own insight and the awareness of his/her own work as a part of the (meta)cognitive functioning. Ultimately, Feuerstein hopes that students will become interested in the material for its own novelty, challenge, and inspiration. Although all the instruments are not necessarily capable of this outcome, it is nevertheless a general goal of the IE program. In the end, Feuerstein proposes that learners will develop a different view of their own perception of themselves as learners. With the sounder success of mediated learning experience, he and his colleagues anticipate that students who master IE will become active

generators of new information, problem solvers, and proactive thinkers.

The IE program also expects that students' standardized test scores will improve. Thus, in the Philadelphia study, the Reading/English/Language Arts, the Mathematics Computation, and the Mathematics Concepts and Application sub-tests of the City-wide Testing Program (CWT) were tracked on the participating students during the course of the project.

Subjects/Methods. The first phase of the project involved the training of the district teachers and staff in the IE materials. This occurred during 1989-1990 and involved the four instruments included in Level One: Organization of Dots, Orientation in Space, Comparisons, and Analytic Perception. Fifty-five educators from eleven schools in two subdistricts took part in this training. Eventually, seven of nine teachers who volunteered to be part of the research effort committed one class of students each for the study. These classes included 161 students who were in the fifth through seventh grades; they were mainly from Latino and African American backgrounds. Twenty-nine of the students were in two special education (mixed-category, mildly handicapped) classes. This group of 151 students constituted the population upon which the entire study was completed between January and June, 1991.

Early in 1991, three researchers from Research for Better Schools -- who were trained in both levels of the IE program -- were engaged to observe the teachers instructing the IE material. They used a common observation protocol and made uniform observation and testing arrangements with six of the participating teachers. These researchers also conducted the pre- and posttest of a sample of the students with the Standardized Progressive Matrices test. Prior to the posttesting of the Raven instrument, these same researchers coached a subsample of the students on test-related skills.

They used a common coaching and testing protocol based on a plan provided by the Office of Assessment of the school district. Following the close of school in June, 1991, school district staff tracked the academic grade records of students in the study. They also kept record of these students' scores on city-wide testing in Reading/English/Language Arts, Mathematics Computation, and Mathematics Concepts and Application subtests.

There were five types of data generated in the study. The Standard Progressive Matrices pretest was administered to 73 students across the nine experimental classes. When students who were absent from the second testing and classes that were dropped from the study were eliminated, a sample of 47 students evenly distributed among seven classes remained. The pre-tests were given in March and April 1991, the posttests were administered in May and June 1991. Two students from each of seven classes were included in the coached subsample on the Raven posttest. Report card marks in English/ language arts, reading, mathematics, science, and social studies were tracked for June 1990 and June 1991 for all students, in order to measure the effect of IE on the students' becoming successful learners in the eyes of their teachers. Letter grades on the report cards were turned into a numerical scale similar to ones used for computing grade-point averages. Scores on the city-wide test as of Spring 1990 and Spring 1991 were tracked on three subtests noted to measure the effect of IE on students' performance on a nationally-normed measure. Normal Curve Equivalent (NCE) scores, based on the publisher's (CTB McGraw Hill for the School District of Philadelphia) national norms were used for this study. Teacher questionnaires were employed to identify the students in the study, the amount of IE instruction that had been conducted by each instructor, and the particular instruments taught to the classes involved. And finally, classroom observations

documented over the course of the study were used to provide contextual information about the instructional program as implemented.

Analyses of the various data were completed by the end of 1991. The study was based on the assumption that there would be naturally occurring variation in the number of occasions that an experimental class would have had IE instruction, and that more IE sessions would result in greater individual student gains. The evaluation strategy was to relate students' exposure through IE sessions to the three measures of student attainment: Standard Progressive Matrices test scores, marks in their regular subject matter courses, and city-wide test scores. Pre-values of the student attainment measures, grade level, and participation in special education, were used to distinguish pre-existing individual differences among students from the effects of IE. Specialized forms of the pre-values were used to explore effects which were strong initially, but then diminished (curvilinear effects), or to explore the ways that IE effected student subgroups (interaction effects). Regression analyses relating the number of IE sessions to the outcome variables were used to evaluate the data. This technique was used in lieu of experimental group-control group comparisons, because there were many teachers who did not volunteer for the study although they had been trained in IE and had received the IE materials. Many students who might have been considered for a potential control group may actually have had IE instruction in these teachers' classes.

Results. The average number of IE sessions between the Standard Progressive Matrices pretesting and posttesting was 14.8 sessions. During this period, the average score for students in the study went from 31.3 to 34.4 raw score points, an average gain of 3.1. Analysis of the test results showed several statistically reliable trends (Offenberg, 1992, p. 10): (1)

Regular education students' scores were increased as a result of participating in IE sessions. The more sessions they participated in, the higher their posttest scores, when the effects of other variables (pretest scores, coaching, and special education participation) were removed. (2) The rate of growth of special education students on this measure was not as marked as the growth rate of regular students. This finding is considered to be tentative because the special education students had more IE sessions than any regular students, making it impossible to separate the effect of IE sessions from the effect of having been designated special education. (3) Coaching improved the posttest scores of students with low Standard Progressive Matrices pretest scores more than the scores of students with high pretest scores. However, coaching students did not improve the ability of the Raven test to detect the effects of IE.

In terms of the examination of students' report card marks in English/language arts, reading, mathematics, science, and social studies between spring 1990 and spring 1991, the findings focussed on the five regular education classes for whom end-of-the-year letter grades were consistently reported. There were 115 students in these classes; their instruction consisted of approximately 21 to 58 sessions of IE. From spring 1990 to spring 1991, students' average marks declined in each of the major subjects. This trend is similar to one found in middle grades of the school district as a whole (Offenberg, 1992, p. 11). For students who received up to 35 IE sessions, the decline of marks was moderated in the following subjects: English/language arts, reading, science, and social studies. One regular class had more than 35 IE sessions. IE seems to have affected student marks less in this class than in the classes that had fewer sessions. Finally, the study showed IE instruction did not affect students'

mathematics grades.

In terms of the city-wide test scores on nationally-normed portions of the spring test in Reading/English/Language Arts, Mathematics Computation, and Mathematics Concepts and Applications, the normal-curve equivalent (NCE) test scores of the five regular education classes in the study were examined. Special education classes were excluded because they did not participate in the City-wide Testing Program (CTW). It was found that program participants' Mathematics Computation NCE scores improved. However, Reading/English/Language Arts and Mathematics Concepts and Applications NCE scores declined between spring 1990 and spring 1991. Participation in IE sessions appears to be correlated with lower NCE scores; the greater the number of IE sessions, the lower the test scores. "It is not known whether IE instruction interferes with teaching the skills measured by these tests, or whether there is some other cause for this finding" (Offenberg, 1992, p. 21).

Conclusion. The Philadelphia schools study suggests that IE is a valuable instructional program that shows positive effects for urban adolescents' learning. In less than a school year, despite the fact that observation reports indicate that extensive bridging between the innovative program and traditional classroom instruction did not generally occur, IE had positive effects for minority, middle-grade students. These effects were evident in two types of outcomes: better marks in language-based subjects and improved non-verbal measures of intelligence. These results suggest that students improved in areas where teachers were able to mediate more successfully and on an assessment instrument that is similar to the particular IE materials. Student performance on the city-wide, standardized test needs to be examined further, especially with regard to how instruction

and testing are related to aspects of mediated learning such as content bridging.

Implications of the Research

The Vygotskian study highlights the fact that the ability to identify and to deal with contradictory information is essential for successful learning. At the same time, it shows that even educated adults seem to be ill-prepared for this task when it needs to be carried out outside their narrow area of specialization.

The study also shows that spontaneous discovery of contradiction, even when it lies completely within the framework of everyday experience, is rare. The usefulness of verbal and pictorial tools-mediators, explored in the Vygotskian tradition, is limited if there is no mediation of meaning.

The IE program developed by Feuerstein and his associates may serve as a useful technique for enhancing analytical, exploratory, and contradiction identification strategies in poor performers. The effectiveness of these strategies, however, depends on interaction with the subject's content knowledge. It seems that the Vygotskian distinction between "scientific" and "everyday" concepts is appropriate here. If a subject's content knowledge is organized around non-scientific, everyday experiences, his/her ability to utilize cognitive strategies remains limited. Everyday experience interferes with the logical train of thought that may eventually lead to the correct identification of contradiction.

Two lines of future research can be suggested from this study. One of them is the exploration of how the mediation of meaning can be incorporated into the Vygotskian psychological tools paradigm. The second concerns the development of "bridging" techniques within the IE program in such a way that cognitive strategies are linked to the content knowledge areas such as

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physics, biology, or mathematics. The latter attempt may produce a synthesis between the Vygotskian notion of "scientific" concepts and Feuerstein's emphasis on the development of cognitive strategies.

The Philadelphia study shows that Feuerstein's innovative instructional program can influence adolescent students' thinking in a relatively short period of time. As an intervention tool of learning, IE materials were effective in changing the ways students work in middle grade classrooms. The gains in student performance on the Standard Progressive Matrices test seemed most directly related to the new classroom experience provided by IE, especially on the Organization of Dots exercises. The growth in language-based subject areas, as reported by report card grades, suggest that the goals of IE instruction carried over to student performance in those particular content areas beyond the Feuerstein program. The question of how to bridge classroom IE experience to mathematics construct learning appears to be a topic of needed future research, but the fact that student learning requires such integration seems to be obvious. Were the middle-grades students influenced by greater mediation? The success of the coaching subsample on the posttest of the Raven test, especially for lower performing students, suggest that indeed they were.

Although this middle grades study provides some interesing data about student change in this large city school district, it also raises some interesting questions about teacher change. Teachers' questionnaire comments indicate that, after initial use of the innovative program, they began to see some of their students in a different perspective. Some students seemed more motivated by the IE materials than by the traditional instruction; some youngsters showed greater spontaneity and curiosity about their work. Some students appeared more engaged in the learning; they

seemed to persist longer at tasks, even at taking the Raven posttest. Had the students changed and/or the teachers? Had only mediation of meaning developed or, as Feuerstein advocates, had intentionality/reciprocity and transcendance also occurred? The results of this large school district study suggest some areas of significant, future research concerning mediation, particularly in terms of specific, classroom interactions and long-term change among students and teachers.

Conclusion

Returning to the four questions that began this study, much has been revealed abou both Vygotsky's and Feuerstein's contribution to the concept of mediated learning. Both theorists take a strong sociological approach to the development of intelligence and cognition. They both see such development as a dynamic process; they concur that human modification is gradual, as well as natural. From the thirties, when Vygotsky wrote, to Feuerstein's views today, their socio-cultural psychology seeks to place human beings in a larger biological context, but also in a unique position. Like Childe (1951), they see humans born with relatively few inherited instincts, but they note that "the human parent can teach not only by example, but also by precept" (p. 29). In that symbolic world, mediation for learning is an important key to survival and success.

Vygotsky's and Feuerstein's approaches do not always perfectly match. Kozulin (1991) points out that Feuerstein makes an important, though not fully elaborated, distinction between functions (Vygotsky's concept) which serve as prerequisites of cognition, and cognitive operations which correspond more or less to the Piagetian notion of intellectual operations. Thus, classification, to the Israeli psychologist, is an operation which might be ineffective because the function of using two different sources of

information is deficient. At the same time, an absence of a specific type of hypothetical reasoning in a culturally different individual may be merely a result of his/her particular experience and not a sign of deficiency, as long as the prerequisites for such an operation are present. In one sense, Feuerstein designed his IE program to develop such prerequistes for learning among low achieving performers.

Of what significance is mediated learning for effective instruction? It seems to have been a key ingredient in both field implementations studied. Perhaps, its first important role showed that the prerequisite of mediated learning helps a teacher focus on what is significant to the success of the learner. At the same time, both Vygotsky and Feuerstein are not surprised at the diversity and variation among learners. They agree that the learner's needs and abilities are the central issue of planning effective instruction. Along with many researchers today (Campione, Brown, Ferrara & Bryant, 1984; Goldenberg & Gallimore, 1991), their mediated learning best includes a dynamic approach to classroom diagnosis and assessment and a learner-centered orientation to curriculum and instruction, especially for individual concerns. Similarly, for the needs of particularly disadvantaged groups of youngsters, such as those described in the large city school district experiment, addressing group needs may be another essential aspect of sound, effective instruction as well as large scale intervention (Presseisen, 1992).

In both the empirical studies, the use of significant tools of instruction, embedded in the scaffolding or apprenticeship models of learning as described in Vygotskian terms, seemed to highlight the tasks of internalization of ability through mediation among differing populations of learners. Whether adult immigrants from another country or low-achieving

adolescents with backgrounds different from the mainstream culture, the social interaction involved in learning the Feuerstein instruments became the "tool" for transcending the cognitive limitations within these different groups. In that respect, mediated learning holds unique hope for the improvement of different populations of students all over the world. Finding the appropriate tools and planning their use in an effective sequence of instruction may also be an important aspect of sound teacher preparation.

Finally, how might mediated learning extend cognitive psychology's new paradigm for education? First, an emphasis on mediation suggests a strong theme of metacognition and mindfulness for every learning environment. The teacher's overall role may significantly shift from that of information provider to learning facilitator, but, by the same token, the student can become self-regulated, independent, and creative. Secondly, mediation provides a useful link between thinking processes and the concepts of content. The emphasis here is that of meaningfulness and significance -- in making the ideas of a discipline come to life in the thoughtful classroom. And finally, mediated learning legitimizes thinking at school, as well as learning at home and in the full community. The question is not whether the student is ready for school, but rather, what can be provided in the classroom to help every learner take advantage of and progress in terms of his/her unique potential?

Vygotsky and Feuerstein provide much food for thought for the mindful educator. Like Piaget, their intellectual forebear, their work suggests there is nothing like a good theory for practice.

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